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ABSTRACT

Three papers are presented in this monograph. The first--Trends in Process-Related Research on Curriculum and Teaching at Different Problem Levels in Educational Sciences--provides a re-analysis of research about the influences of certain environmental factors on student achievement. In the second paper--Frame Factors and Teaching for Mastery--the problem of mastery learning is reviewed from the point of view of the curriculum planner or evaluator. In the third paper--The Curriculum Development System in Sweden: Some Comments on Present Trends and Problems--phases in a reform cycle, frame factors, research, and policy-making are discussed. A bibliography is provided. (DS)

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Urban Dahllof

CURRICULUM EVALUATION, FRAME FACTORS AND TEACHING FOR MASTERY

Reprints of three articles

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SUMMARY

Dahllöf, U. 1978: Curriculum evaluation, frame factors and teaching for mastery. Reprints of three articles. Uppsala Reports on Education 2 (63 pp).

In one of the articles reprinted in this report the author tries to synthesize earlier research on curriculum and teaching with special regard to various problem-levels in education and to the role of frame factors and process variables for the interpretation of outcome data so often characterized by non-significant differences in general tests. That article was originally presented as an invitational address to division B of American Educational Research Association in 1973.

In another reprint from the same year the Swedish curriculum development system is analyzed with regard to strong and weak points in the reform strategies in the late 1960s.

The third article has earlier been published only in German. The author discusses mastery learning from the point of view of teaching and with regard to the restrictive impact exerted by a frame factor as total amount of time at disposal for school learning. The conclusion is that also mastery learning is subject to limitations as a general principle and that it calls for an increased attention to the priority problems in curriculum planning.

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Preface

This report contains reprints of three articles of mine from the early 1970s. The reason to re-publish them in this form is entirely pragmatic: No more off-prints are available. At the same time, the articles have been handy to use as references when we have tried to explain the consequences of some more fundamental research which was carried out in the period 1967-72 mainly under the auspices of the Compass project and which still is underlying some of our research activities.

Moreover, one of the articles - "Frame factors and teaching for mastery" - has up to now only been available in German, though it has a somewhat strategic position from a theoretical point of view. Finally, the three articles were written during my time at the University of Göteborg, so even Swedish readers here in Uppsala who want to familiarize themselves with some of our earlier work, may have use for a reprint.

I have not made any changes in the texts except for corrections of obvious printing errors.

Uppsala, July 28, 1978

Urban Dahllöf

1. TRENDS IN PROCESS-RELATED RESEARCH ON CURRICULUM AND TEACHING AT DIFFERENT PROBLEM LEVELS IN EDUCATIONAL SCIENCES[1)]

Reprint from Scandinavian Journal of Educational Research 19, 1974, 55-77

Abstract

Dahllöf, U. 1974. Trends in Process-related Resarch on Curriculum and Teaching at Different Problem Levels in Educational Sciences. Scand. J. educ. Res. 19, 55-77. A re-analysis is given of the research about the influences of certain environmental factors on student achievement. The study indicates that educational process data seem to be helpful in building up an explanatory model not only on the macro systems level, but also on the classroom interaction level. Seven promising characteristics of the approach are pointed out, the consequences of which broaden the paradigms and models of research on teaching. The author argues that his findings and the models drawn upon, both theoretically and empirically give strong support to claims for a reorientation of educational research as published by Westbury (1971), Gowin (1972) and Scriven (1972).

Introduction

One of the most important questions that can be put to educational scientists today seems to be under what conditions do process-data make any difference to non-significant test differences. The question highlights the need for a more profound understanding of relationships

1) This is a slightly revised version of an invitational address presented to Division B of the American Educational Research Association at the annual meeting in New Orleans, February 27, 1973. The address was given under the title 'Data on curriculum and teaching process: Do they make any difference to non-significant test differences - and under what conditions?' I wish to thank Professor Arno A Bellack, Teachers College, Columbia University, who has stimulated our thinking and promoted our research in a number of ways during the last few years and Dean David Turney, Indiana State University, Terre Haute, Ind., who as program director has given me most valuable assistance. Thanks are also due to Dr Ulf P Lundgren, Assistant Professor at the University of Göteborg, and associate project director, and to Mr Daniel Kallós, fil lic, Institute of Education, University of Lund (cf. Kallós 1973).

in an area that has been dominated for too long by numerous empirical studies with only weak theoretical skeletons. In a survey of Swedish school research, Alkin & Johnson (1971, p. 20. Cf. also 1972, p. 56) recently had good reasons to warn against 'massive correlational fishing-trips' - a warning that no doubt is justified in the area of curriculum, teaching, and educational process research on both sides of the Atlantic. There is hardly any scholar today who would dare to say that he is satisfied with the state of affairs of research in the area. On the contrary, most researchers seem to suffer from something like frustration.

But as long as there is frustration, there is hope: frustration leads to activity and there is, indeed, quite a lot of activity in the field. Something substantial will certainly come out of all this sooner or later. We are, however, searching for outlets in many directions, all of which may not be equally fruitful. The purpose of this paper is to discuss some of the main problems of strategy that arise out of this frustrating situation.

The question takes it for granted that there is agreement so far that there is an abundance of studies showing non-significant test differences. The question also takes the position that data on the educational process - somehow and under some conditions - may be of some help, but nothing is said about the kind of research we have in mind, nor is anything mentioned about the independent variables. Let us therefore first discuss some general statements about levels of educational research.

Levels of educational research

- Educational phenomena can be studied at different levels, ranging from very detailed studies of classroom behavior to the systems analysis of comparative education.

- This range can be regarded as a micro-macro dimension. If so, it has, however, to be borne in mind that these terms are relative to the general definition of the field. From the standpoint of psychology - and especially the psychology of learning - the micro-studies of classroom behavior would no doubt represent a macro-level. On the other hand, social economists working in the field of educational planning have good reasons to classify our approach to systems analysis in comparative education as micro-level studies from their point of view.

- Psychology of learning, like educational psychology in general, has been deliberately left outside this treatment. There seem to be no good reasons for any reductionism between psychology and education. As things stand, it appears to be wiser to assume that the problems of education cannot entirely be reduced to psychological principles, than the opposite, nor are there any good reasons to expect that problems of curriculum and teaching can be entirely reduced to the laws of learning.

- On the other hand: in order to be fruitful, educational research must clearly be compatible with established facts and principles of learning and also with the status of other neighbor sciences. Thus, compatibility with the psychology of learning is a necessary but probably not a sufficient condition for educational research.

- If the reasons in favor of reductionism over the boundaries between psychology and education are weak, there are for similar reasons no good arguments for any reductionism between the different levels of research within the field of education. Thus, it does not seem fruitful to expect that problems at the systems level of comparative education can be reduced to micro-teaching principles.

- The principle of compatibility and the distinction between necessary and sufficient conditions do not prevent researchers working at different levels from helping each other. Quite the contrary. There can probably be a fruitful exchange of ideas, concepts and approaches in both directions provided that the discussion is continuously adapted to the problems characteristic of each level.

- At present there seems to be a striking similarity between different levels of study within education, at least in so far as there are signs of frustration caused by the anemia of non-significant outcome differences both at the micro-, medium- and macro-levels.

Classroom behavior and interaction

One wide field is classroom behavior and interaction. It is, indeed, too vast and contains too many research traditions to be summarized in a few words. In this connection, however, we are primarily interested in those studies within these traditions that have investigated the direct relationships between different types of behavior or interaction patterns and educational outcomes. Here, Rosenshine (1970, 1971a, 1971b) has recently published a series of analytic surveys of the research field. In spite of the vivid activities in developing observation systems in the affective domain such as those of Flanders (1965, 1970) and others (Amidon & Hunter 1967), in the cognitive area (Bellack et al. 1966) or of a topic-centered kind (Gallagher 1970a, b), the net result of established findings seems to be fairly meager when it comes to the relationships between specific behavior as well as patterns of behavior in the classroom on the one hand and student achievement on the other. This is partly due to the fact that there is a rapid decrease in the number of studies on this particular problem, but Rosenshine (1971a) does also note quite a lot of puzzling inconsistencies among those investigations that fulfill demands of compatibility. Now

and then Rosenshine is forced to conclude that findings are running counter to what seem to be quite trivial expectations, at least when they are based on psychology of learning. One of the main conclusions from the Rosenshine reviews is a warning against too far-reaching practical conclusions, e.g. for teacher training purposes, before we have arrived at a more coherent understanding of the relationships within the field of teaching. A warning of a corresponding kind is also issued by Nuthall (1971).

When it comes to recommendations for further research, Rosenshine (1971a) reminds us about the reviews of Ackerman (1954) and Morsh & Wilder (1954), who recommended a shift from high-inference rating scales to low-inference techniques for a more objective observation of teaching behavior. This shift has now taken place - but we are still confused.

The main point in the sympathetic message from Rosenshine is the following: 'The next shift should be toward greater precision in recording, reporting and analyzing results.' (Rosenshine 1971a, p.94). Let us in this connection only make the comment that improvements of this technical kind will of course be welcome as helpful, but let us also insert a question-mark in order to stimulate the discussion on this point: although a greater technical refinement would be a helpful tool or even a necessary condition, will such a greater precision really be a sufficient condition?

It is, by the way, a little easier to follow Rosenshine when he joins Norma Furst in another survey, which seems to put somewhat more stress on the theoretical considerations, e.g. when they propose more experimental research. Similar points of view are touched upon when Rosenshine & Furst (1971) discuss the selection of variables. One gets the feeling that this is fruitful ground, which, however, is still hiding if not treasures, at least some coins. Referring to, among others, Nuthall (1968) and B O Smith and co-workers

(1962, 1966), they also point to the fact that bridges are occasionally built between classroom and laboratory research. Let us in this connection put another question this way: What about bridges between classroom research - as traditionally carried out - and research on a macro- or systems-level?

Before reaching the other end of the research continuum let us make two short stops not far from the classroon observation research level.

Teacher effectiveness

The first stop is, indeed, part of the classroom interaction field, although it may be looked upon as somewhat more concentrated upon the characteristic behavior patterns of the teacher. Another reason for a special discussion is the influence that in this area is exerted by Gage and his group at Stanford. In his recent book Teacher Effectiveness and Teacher Education (Gage 1972), Gage seems to take a relatively optimistic position to the problems of concern here - or at least the publisher tries to convince us in the text on the dust jacket that Gage is optimistic.

The starting point for a shift towards optimism is, however, a pessimism that according to the publisher is no longer warranted. So far there has no doubt been much to support such a pessimistic attitude. Let me just quote one passage from Gage.

'The early years of research on teaching have not paid off in solid, replicable, meaningful results of considerable theoretical or practical value. Positive and significant results have seldom been forthcoming, and they have survived replication even less often. The research has yielded many findings that do not make sense, that do not hang together in any meaningful way.' (1972, p. 114)

What about the support for a shift towards an attitude of optimism? One point is some trends towards significant positive relationships as regards such variables as warmth, indirectness, cognitive organization and enthusiasm - factors

among which Rosenshine (1971a) found so many inconsistencies that he took a much less favorable position.

Another point is the neglected area of individualization that almost by definition can be expected to be a gateway to a more prosperous future, not the least in terms of what Cronbach has named 'aptitude-treatment interaction studies', which will be considered at the next step, with little support for any optimism.

In these and other respects Gage provides arguments for expectations of a theoretically meaningful pattern of positive findings, provided that future researchers make certain changes in their designs and research strategies. So far there is little evidence of a more positive attitude today - but some hope for the future. This depends in turn on the fruitfulness of the recommendations stated.

There is, indeed, a great variety of considerations to be adopted. Among many other things Gage offers a perspicacious discussion of the relation of theories of teaching to theories of learning, he analyzes the importance of theories and paradigms in general, he reminds us of the somewhat disstressing fact that none of the models reviewed 'has come to grips with the complication that teachers typically deal with more than one pupil at a time ... Just how interactions between teachers and pupils should be combined to characterize significant processes and outcomes in the classroom has not been dealt with in the foregoing paradigms.'

Having said this, Gage, however, continues: 'At the present stage of paradigm development this gap does not seem to be an urgent one. When more experience has been gained in providing operational definitions for the paradigms, the problem of combining interacts into ed ationally significant units will become more realistic.' (Gage 1972, p. 109).

As far as I can see this statement is equivalent to taking

the position that the most fruitful paradigms are those which take their starting point on a psychological level - perceptual and/or behavioral. This is also in line with the two main recommendations that seem to be the very core of the message. The one is the development of programmed learning and machine paradigms - mainly in accordance with recommendations by Stolurow (1965), when he put his famous question: To model the master teacher or master the teaching model? One main reason for Gage's recommendation of machine paradigms is that they help the understanding of the function of live teachers: 'Systematic comparison of machine functions and those of human teachers, function by function, may reveal the proper and unique role of each. Paradigms for human teaching comparable for those for teaching machines will help in making such analyses.' (Gage 1972, p. 113).

The other main recommendation is micro-teaching analysis, 'breaking down the complexities that have proven to be so unmanageable when dealt with as a whole.' (Gage 1972, p. 123).

There are, no doubt, good arguments in favor of multi-dimensional criteria of successful teaching - even on a micro-level. So far, micro-teaching is an interesting field of research per se, the development of which may be a necessary condition for understanding the relation-ship between teaching and student achievement. Once again, however, we may question if the recommendations discussed here at the same time represent a sufficient condition. There is much in Gage's own book to support such a doubt. Among other things, Gage (1972, p. 97) reminds us about Jackson's (1966) distinction between preactive and interactive phases of teaching. Referring to Cronbach (1967) he also reminds us about the spontaneous facets of the game, 'the uncontrived character, speed and uncontrollability of teaching moves.' (ibid. p. 97.) And - in connection with the Stolurow-based recommendation

of machine-paradigms as guides to human teaching - we are requested to analyze the programs that teachers carry around 'in their heads'.

But shall we really take it for granted that what goes on in the heads of the teachers and at the same time means something for their decisions and behavior, shall we really assume that all this is limited to the micro-level of the present situation? What about the interaction between the preactive and interactive phases of instruction, between the long term and middle term plans, intentions in relation to curriculum objectives on the one hand and on the other hand the various steps and decisions taken within a single lesson or a short series of lessons? Isn't there a risk that to rely only on a breakdown of the complexities will lead us to another blind alley? Do not Jackson's contribution and not least the 'the complexities of an urban classroom' as analyzed so cleverly by Smith & Geoffrey (1968) urge us to take even higher-order complexities into systematic account in our paradigms on teaching?

Aptitude-treatment interaction

The next step will be much shorter, even though the field is also a complex one. We are now approaching the program level, where a certain method or style of teaching is applied for a shorter or longer period in order to suit the specific needs or abilities of the students. According to the summaries by Cronbach & Snow (1969) and Bracht (1970) there is no doubt that the whole field of aptitude-treatment interaction is suffering from the frustration of non-significant differences, and yet this is a field in which differences of a certain direction could in many cases be expected for very good theoretical reasons. Typical of research in this field seems among other things to be the short duration of the treatment and the little concern for what really goes on under the label of treatment. Thus one main conclusion by reviewers of this field is to concentrate more on the educational process that is actually taking place both in

terms of teaching and learning, avoiding taking for granted that what is expected from the instruction is also taking place among all participants.

This area is by definition relatively close to the field of teacher effectiveness and micro-analysis of teaching behavior and classroom interaction. It has, however, to be noted that - in spite of the common characteristic of frustration - there seems to be a difference in the symptoms of the disease: at the micro-level, behaviors and behavior patterns of different kinds are in various combinations taking the place of independent variables and so far there is no lack of information about the details of the process, as seems to be the case at the research level of aptitude-treatment interaction.

Here, on the other hand, much attention is paid to individual differences and their role for the students' ability to profit from a certain type of instruction - while at the classroom interaction analysis level students are generally treated as equal, little attention being paid to individual differences or to subgroups of students.

It has also to be noted that in both cases factors like curriculum contents, type and level of objectives as well as the general environment are kept constant according to the established rules and massive tradition of experimental psychology. This may be quite in order for the single study and from a general point of view of design. But when it happens that in the long run the same factors or a certain set-up of factors are always kept constant, these factors are running the risk of total neglect even though they do in fact exert a certain influence.

Research on the environment and frame conditions

In order to survey research on environmental factors and their influence on scholastic achievement we have to take

another step on the ladder up to field studies of a sociological kind and on a level of complex systems as in comparative education.

Environments can be classified in many ways. Let us start with factors relatively close to the teaching situation, such as size and characteristics of the school and the class that is subject to our teaching efforts. Typical of research in this field, among other things are:

- The assessment is generally made by means of standard group tests of a fairly general type, data being collected at the end of the school year or even longer after the environmental factors under study have been introduced to the students.

- When corrected for differences in initial ability, social background and the like, the tests generally show few significant differences, if any at all. Moreover, the pattern of significance is in many cases inconsistent and the differences are often too small to be of any practical importance for planning or other types of decisions.

- The investigations are generally held at a purely descriptive level. Although differences are often expected not only by teachers, school leaders and the general public but apparently also by the researchers themselves, there are few, if any, efforts to explain the outcomes by means of an alternative model or pattern of hypotheses.

- Almost nothing is known about the characteristics of the educational processes behind the test results (Dahllöf 1971a).

It is at this point that our own emporical data from project Compass for the first time have a chance to make a

contribution. Originally they were collected in a curriculum study (Dahllöf 1960) that was carried out in the late fifties under Torsten Husén in connection with the Swedish comprehensive school reform (Husén & Dahllöf 1960, 1965).

Before turning to research details some words should perhaps be mentioned about Sweden and Swedish school reforms. The school system is highly centralized. For each school form there is just one curriculum, issued by the National Board of Education, stating the same objectives for all students in a subject in a certain grade. The same organization covering optional courses and subjects is used in all school districts. There is, however, a considerable freedom for the local boards of education and for the single teacher to choose textbooks, sequence the contents and also to choose methodology of teaching and working forms for the pupils.

From 1950 the old European parallel school system has been integrated into a comprehensive school, starting at the age of 7 and lasting for 9 years. Then there is a three-year senior high school preceding the university level.

The comprehensive school was to a large extent introduced in order to promote social equality. Its curriculum philosophy is progressive with great stress on the development of the whole child, cooperation and group work as well as on the unselected heterogeneous class at the best environment for the fulfilment of these ends. The reform called for a radical change of teaching methods from traditional classroom instruction to a great deal of individualization within the comprehensive class (Husén & Henrysson 1959, Paulston 1968, Marklund & Söderberg 1968, Beauchamp & Beauchamp 1972).

The committees preparing the reform drew considerably on educational and sociological research in their planning. One of the most important fields of research and argumentation was the influence of social background factors on the enrolment to higher studies and success at school. Here, early studies by Boalt (1947) and Husén (1948) played an important role. This theme has been followed up in a number of later studies by Husén, who became one of the most prominent spokesmen for the reform. (See Husén & Boalt 1968 for further references.) Among the research studies ought also to be mentioned a series of investigations by Härnqvist (1958, 1960, 1965, cf. also Härnqvist & Bengtsson 1972) on the reserve of talent, inter- and intraindividual differences in relation to the problems of differentiation, enrolment in relation to social background, etc.

Between 1950 and 1962 a first version of the comprehensive school was tried out in a number of school-districts clustered in regional areas. The intent was to test different ways of organizing the upper section, i.e. grades 7-9, corresponding to junior high-school, but for various reasons

very little same of this experiment that could serve as a guide for the decision-makers about the merits and demerits of different ways of organizing the school work. So when the final decision was to be taken in 1962 there was only one study in the area of ability grouping and scholastic achievement.

The only study about the effectiveness of different kinds of school organization that existed before the final decision on the Swedish comprehensive school, made a comparison between the old selective system and the experimental comprehensive system that were running parallel to each other in different parts of the city of Stockholm (Svensson 1962). It was, from a technical point of view, a very good study, introducing analysis of co-variance on field data. When keeping initial ability and social background constant, as usual no differences were found between classes belonging to the selective and comprehensive system.

A re-analysis some years later, however, showed two things (Dahllöf 1967, 1971a). First, it was found that the tests used were very basic, and - incidentally - not equally fair to the systems under comparison. As a matter of fact, the functions studied were so basic that they had already been subject to teaching and learning before any differential treatment had taken place, the effects of which formed the main purpose of the Stockholm investigation.

Second, from the old curriculum studies (Dahllöf 1960) we happened to have access to data on the educational process. These in turn were of two kinds (Dahllöf 1967, 1971a).
(1) Data about the general pattern of teaching were collected. Here it was revealed - contrary to recommendations and expectations - that traditional classroom instruction was equally prominent in both types of school. Thus, when the great majority of teachers (95 %) had to introduce a new curriculum unit or topic, they addressed the whole class at one and the same time. Some individualization did occur but only in the training phase within a certain topic and not over curriculum units. Thus, the more clever students

had to wait for their slower classmates before they could proceed by taking up a new unit. This condition is very important for the theoretical model to be presented a little later on. (2) The curriculum was divided into a great number of units and main units, each unit being classified as to content and the corresponding taxonomical level. In this connection it may suffice to distinguish only between basic or elementary units and advanced units. For each unit we had assessments from a representative sample of teachers as to the number of lessons that were devoted to the different units during the school year. The first analysis was made in Mathematics for grade 7, distinguising between students who had been transferred to the selective junior high-school classes from grade 5 and from grade 7, the latter having spent grades 5-6 in comprehensive classes. The total number of hours was about the same.

The main findings were as follows. With regard to basic teaching strategy, there was no difference, nor were there any differences in the total amount of time spent on the subject. Let us then turn to the amount of lessons spent on the elementary curriculum units, the attainment of which was studied in the tests. Here we have a difference that is not only significant but also relatively great. The number of lessons in the comprehensive classes were 42 out of a total of 96, whereas the positively selected classes did not spend more than 13 lessons on this kind of unit. The plus-selected classes spent more than 80 of the 95 lessons on the more advanced units, in contrast to 56 in the comprehensive classes, but here the attainments were not tested. This being the case - and provided that there is any correspondence between the general ability of the class and the number of lessons needed for teaching a unit by the method used - the level of achievement ought to be higher.

Thus there was a difference between the grouping systems, but it did not appear as a difference in the level of

performance in the standardized tests of elementary Mathematics. Instead the difference came out in terms of time in a ratio as big as 1:3 for an equal level of attainment in basic curriculum units - and in terms of time as well as level of performance in advanced units.

From a practical and political point of view this outcome will of course involve some frustration for those who had drawn the too simple and far-reaching conclusion that ability grouping does not have any influence at all. But since most of the advocates of the reform had been criticizing the old secondary school and its medieval tradition for putting too much stress on memory and intellectual goals, the first results, as reported by Svensson (1962), may be said to be too good to be true: they simply meant that there was no price to be paid at all on the intellectual side for favors in other respects, socially and with regard to the personal development of the students. Now there appeared a price - so why not pay it, which most of the spokesmen no doubt had been prepared to do, or try to lower the cost by breaking up the basic pattern of teaching in favor of individualization within the comprehensive class.

From a theoretical point of view the inclusion of process data gives rise to a systematic model about the relationship between objectives, environmental conditions, teaching method, teaching time and level of attainment of the students. The details of the model have been presented elsewhere (Dahllöf 1967, 1971a). Here we will underline only some main points that need to be considered in order to arrive at an explanation that at the same time is compatible with facts and models from situations where there is a great deal of individualization, at least with regard to pacing, as in programmed instruction.

(1) The level of objectives is important. In this particular case this can already be illustrated by the rough distinction between elementary and advanced curriculum units. The

elementary units are basic and important to the extent that there is a demand for a high level of performance not only in both school systems but also by the great majority of students within each system. Skewed distributions and ceiling effects in the tests are also shown. So far, the findings may be regarded as a special case under limited conditions of the Carroll (1963, 1965, 1971) school learning model and the Bloom (1968, 1971a, 1971b, 1971c) mastery learning principles. Even though Cronbach (1971) has questioned parts of the Carroll and Bloom models as a general principle, I would like to point out that this particular case - elementary curriculum units of Mathematics - seems to correspond fairly well to the criteria held up by Bloom (1971c). Things like addition and multiplication, basic problems solving tasks such as per cent, discount and interest, etc. quite simply are so important both for further studies in the subject and for practical life, that something very close to mastery is demanded, even though it takes many more lessons to reach that level in randomly grouped, heterogeneous classes when traditional classroom instruction is used.

(2) It has to be observed that the time factor here does not directly reflect school learning - but school teaching of mastery learning. Thus the model does not say anything about the psychological details of the learning process except for the basic fact that students need different amounts of time irrespective of what kind of learning is involved. Whether it is a unidimensional training process or, as Cronbach (1971) suggests, a cognitive process of a multidimensional kind is of secondary interest in this connection.

(3) In this case we are interested in the influence that is exerted by a certain set-up of environmental factors. When systems are compared with regard to the effectiveness in their operation, it follows by definition that the outcome measures ought to be strongly related to objectives as well as to the processes that really have been going on

when the factors have been operating. Thus, there is a demand for high content validity.

(4) Concerning the environment, let us make another rough distinction between, on the one hand, the general social, economic and cultural aspects of the environment and, on the other hand, such factors that constitute the immediate background and the environmental conditions for the teaching. The general background as here defined is a fixed feature of the school system that cannot within reasonable time be subject to change and in any case not by the school authorities.

(5) The immediate background for the teaching situations, on the other hand, consists of such conditions that at least in principle are under the control of the school system (if not of the single teacher).

Three main factors belong to this group: first, the physical characteristics of the school: size and structure of school buildings, distance between school and home, supply of teaching aids, etc. Second, administrative factors or rules of organization: principles for class-size and grouping of students; length of school-year and school-day, number of lessons a week in a given subject and so on and so forth. We would also like to include, third, the characteristics of the teacher with regard to the repertoire of teaching patterns which he has been trained to use.

Although these factors may be changed now and then, they are, from the point of view of the single teacher, very often permanent for a considerable amount of time, e.g. a school-year. They represent the conditions under which the teacher has to do his job when trying to fulfil the objectives of the curriculum. In order to underline the role of these immediate environmental factors in the front line of the teaching situation for the dynamics of the teaching process we have used the term direct frame factors or simply

frame factors (Dahllöf 1967, 1971a, 1971b).

The main point is that these frame factors may be regarded as the primary expression of the very fundamental fact that schools are operating with limited resources. The frame factors thus restrict the time and space for the different types of teaching activities, which means that certain, psychological and/or physical barriers are being developed from the point of view of the teacher in his role as an administrator and coordinator of the learning activities of the students. This view of the frame factors has been developed in much more detail in more recent studies within our project by Lundgren (1972a). He also points out that even the objectives may act and be regarded as frames, e.g., when time is restricted and there are several objectives to be achieved, the time for teaching the first units restricts the degree of freedom to be used on the latter ones. Since the goals and objectives already have an established place in our paradigm and since they also may be said to exert an activating force, we prefer in this connection to treat them separately and to reserve the term frame factors for the immediate and strategic environment of the teaching situation.

Now, in the ability grouping case just mentioned a combination of three frame factors is of strategic interest:

(1) The total time at disposal during the school year for the Mathematics was about the same in the positively selected and in the comprehensive classes.

(2) Lack of appropriate teaching aids as well as lack of sufficient in-service training restricted the repertoire of the teacher to the traditional class-centered teaching pattern.

(3) The composition of the classes was different with regard to general ability, prior knowledge and social

background. Even though the size of the classes was somewhat greater in positively selected settings, the main difference between the heterogeneous comprehensive school classes on the one hand and the positively selected, homogeneous classes on the other hand is the relative lack of so-called slow students in the latter. Thus the difference between the systems in general ability is greater at the 10th-25th percentile than at the median.

These frame conditions now - according to the model - interact in the following way. Since there is a demand for something not far from mastery in the elementary curriculum units, this means that the teacher is under pressure to see to it that the great majority of the students in the class reach the level of objectives. Thus the students somewhere in the region between the 10th and 25th percentile within the class become something like a reference group or - as we have called it - a steering criterion group for the teacher's appraisal of the progress of his students and for his decision to leave the old curriculum unit and to proceed to a new one.

When various other studies are combined - e.g. the Swedish reports and the Borg (1965) study from Utah - there are already supporting indications for the operation of such a steering group (Dahllöf 1967, 1971a). Since total time was not only restricted but also the same in the two systems under comparison and since it takes more time to teach the slow learners at the lower end of the distribution in the comprehensive classes to reach mastery, a greater part of the total available time is spent on elementary units in these classes than in the positively selected ones. This also means that the clever students in the comprehensive classes must wait a longer time for their slower classmates before they are allowed to take up a new topic. Meanwhile they are doing something else or are busy with so-called enrichment exercises, which in elementary units often imply no more than a greater number of numerically - but

not necessarily logically - more difficult examples. The outcome of this is overlearning of low additional return.

We have here at some length presented notions that hold a key position in our curriculum-related model of classroom teaching, viz. the concepts of frame factors and steering criterion group. Of these the frame concept is of a more general kind, while the phenomenon of a steering group is subordinate so far as it may appear in the traditional class-centered instruction under certain frame conditions, such as when time is restricted but the objectives still call for a high level of performance. This also means that it is not bound to a certain part of the distribution. The indication of a steering group somewhere in the lowest quarter of the distribution is consequently a function of high demands and relatively plenty of time. When there is a change, e.g. in terms of an unexpected loss of a number of lessons at the end of the school year, then the steering group may move upwards, which simply means that the teacher is forced by the conditions to lower his ambition on part of a greater number of pupils, leaving more of them behind. On the other hand, when instructional aids and teaching competence are at hand and time is not restricted, no steering group phenomenon can be expected - and this is the frame condition for an individualized instruction for all students as a necessary (but probably still not sufficient) condition for mastery learning.

Before we go down to the classroom instruction level again, let us make two short comments, the one on mastery learning and the other on frame factors and comparative education.

As regards the mastery learning problem, I should like to draw attention to the very simple fact that time almost always seems to be restricted as far as schools and other similar institutions are concerned. This calls for a new concern for the priority problem and balance problem within curriculum theory. What part of the curriculum

should be subject to our mastery teaching efforts and at the expense of what kinds of units and activities? (Cf. Dahllöf 1973.)

As regards frame factors and mass investigations of a sociological and comparative kind, there seems to be a quite common methodological problem that is seldom discussed. When group tests and questionnaires are distributed, researchers often collect all the data at the same time on all kinds of variables, and this is so far quite in order. This is, however, often connected with the assumption that variables treated as independent also have been operating parallel to the teaching and learning of the functions studied as dependent variables in the tests. This assumption, however, can be questioned. If the tests, such as the ones discussed above, are of a basic character containing a great number of elementary items, this is very often not the case.

Let us take class-size or age of the teacher as an example - frame factors that are fairly constant for a school year but that may often be subject to change between school years. In general, the analysis is carried through as if the tests have a high content validity and as if the independent factor has constantly held the values for each class that is observed in the group test situation at the end of the period.

The problem case we have in mind can be characterized as a lack of consonance between the operation of the frame factors on the one hand and the teaching and learning of the functions assessed by the test items on the other, either because the test is measuring things that were subject to educational treatment at an earlier stage than anticipated, because there have been unconsidered changes in the frame factors or because both types of errors have been operating. The consequence of this type of error is underestimation of the real role of the frame factor. If factors like these are not under control in more complex

analyses, e.g. in comparisons between school systems in comparative education (cf. Husén et al. 1967, cf. also Dahllöf 1971b, 1971c), it may lead to serious errors in the conclusions.

A return to the micro level

It ought to be obvious from this outline of a model on the macro level, that it does contain a number of assumptions about the detailed interaction pattern of the classroom. Some of these assumptions and consequences have been investigated in a second phase of our project that has recently been reported in a dissertation by Lundgren (1972a). Here 46 classes at the senior secondary school level were followed during the school year in five subjects with special regard to the teachers' plans and intentions on the one hand and the actual process on the other hand. Changes of strategy were of prime interest. In one of the subjects, Mathematics, 8 of the 46 classes, in addition to this, were followed by means of interaction analysis, based on tape-recordings of every third lesson during the fall semester (cf. also Dahllöf & Lundgren 1970, Dahllöf, Lundgren & Siöö 1971).

It would lead too far to report on the details of this study here. Let us only point out some main characteristics.

- The studies by B O Smith et al. (1962), Smith & Meux et al. (1966) as well as by Bellack et al. (1966) have both from a theoretical and a methodological point of view been of utmost importance for the studies.

- The interaction analysis has been carried out through a combination of the systems by Bellack et al. (1966), Flanders (1964) and Bales (1950). For our purposes it was - with special regard to the hypothesis connected with the steering-group phenomenon - of prime importance to identify every individual student taking part in the interaction. Also in other respects the systems were

supplemented by new variables.

- The teacher's perception of the class as a whole and his distinction of different subgroups of students were tested by Lundgren (1972a) by means of a technique of free recall based on Miller's (1967) communication theory. This part of the study sheds new light on the dynamics of the teaching situation in general, and on the frame concept as well as on the steering-group phenomenon in particular.

- The analyses of the interaction patterns also revealed patterns of behavior that hang together in a meaningful way and also confirm the influence of the limiting frame factors as well as the existence of a steering-group under certain conditions. The analyses seem to give support to the general directions from the earlier phase of the Compass project about the possible role of process data in order to highlight the educational processes behind achievement test results (cf. also Lundgren 1972b).

Conclusions

Our re-analysis of research on the influence of certain environmental factors on student achievement has indicated that educational process data seem to be helpful in building up an explanatory model not only on the macro or systems level but also on the classroom interaction level. Some of the more important and promising characteristics of the approach may be summarized as follows:

- Data are curriculum-related, reflecting the goals and intentions of the instructional program as well as the ambitions of the teacher.

- Data are related to basic patterns of teaching, in this particular case class-centered instruction of a fairly traditional type.

- Data reflect the cumulative character of the teaching process and its long-term effects.

- Data mirror the teaching process as a continuous change of perceptions and behaviors over time towards certain goals. They do this also if time for teaching a certain curriculum unit is analyzed as an important variable related systematically to level of achievement.

- The analysis takes into consideration that the teaching of a certain curriculum unit is generally running through a series of phases like presentation, training and control - each phase with its own characteristic pattern with regard to communication and interaction.

- Data are dynamic also in as much as they can be related in a meaningful way to the restrictions that are imposed upon most teaching situations by frame factors like limits of space and time.

- Data are also dynamic in so far as they try to describe and do justice to the role that in the teaching situation and its different phases - and because of the combined effects of goals and frames - is played by different groups of students.

The consequence of this is to broaden the paradigms and models of research on teaching. To broaden instead of breaking down - and to do it in a way that both keeps control of strategic factors and facilitates theoretically meaningful interpretations - is by no means an easy task. It is, however, a challenge that has to be met by varied and systematic attacks in the field instead of by avoidance behavior in the laboratory. And yet, experimental designs, refined procedures of measurement and analysis may still be helpful, even though they do not represent conditions that are sufficient for a real advancement of research in this area.

When related to already existing research data both on the systems and classroom interaction level, the Swedish findings and models that have been drawn upon here, both theoretically and empirically give strong support to claims for a reorientation of educational research as published by Westbury (1971), Gowin (1972) and Scriven (1972). It would lead too far to take up their recent contributions discussion in this connection. These new trends in the thinking about educational research are interesting not only because they may promise significant differences - even though they are located at other places in the model than traditionally anticipated - but also, and more important, because they build bridges between different subfields of educational research, facilitating the development of educational theory. Methodologically and theoretically these new trends also support the development of new strategies of planning and evaluation. To take only one example, part of our own project group will now enter upon a project, aiming at an evaluation - curriculum-related and process-centered - of non-graded schools (Goodlad & Anderson 1963) as a means of a deliberate policy of supporting and strengthening distant rural areas as a living local society (Andrae & Dahllöf 1973).

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2. FRAME FACTORS AND TEACHING FOR MASTERY

Translated reprint of "Rahmenfaktoren und zielreichendes Lehren". In Edelstein, W. & Hopf, D. (Eds.) 1973: Bedingungen des Bildungsprozesses. Stuttgart: Ernst Klett Verlag.

Introduction

Although it is not necessary to be "a believer" in mastery learning as the key principle for educational policy-making for years to come (cf. Block 1971a) in order to find it both fascinating and fruitful for future research, the present writer, taking mastery learning as a point of departure, wants to draw attention to some problems connected with teaching for mastery.

With some simplification one may be justified to classify the underlying Carroll (1963, 1965, 1971) model for school learning as well as Bloom's (1968, 1971a, b) mastery learning principle as basically models within the frame of reference of educational psychology. In both cases one is looking at the problem from the student's point of view.

The approach taken here is somewhat different. Let us look at the problem of mastery learning from the point of view of the curriculum planner or evaluator who not only is dealing with small segments or units of the curriculum but who is responsible for a whole curriculum program that has to be carried out under some specific conditions of the environment which belongs to the educational system. Environmental factors of this kind have been referred to as frame factors (Dahllöf 1967, 1971a, 1971b, p. 75. Cf. also Lundgren 1972).

The inevitable frame factors

As long as we are considering learning taking place at school and as long as schools have limited resources in terms of teachers and instructional aids, we have to face

- at least from a system's point of view - that it is almost inevitable that certain environmental factors are restricting or limiting the instructional processes going on at school.

Certain restrictions and limitations do also characterize this paper and in order not to be misunderstood or subject to the special case of misunderstanding that is over-interpretation, some factors which limit conclusions from our own research will now be listed.

(1) The empirical contributions are stemming from a country, Sweden, the school system of which is highly centralized with regard to decisions about curricula, their main objectives, the allocation of time to different subjects and the like.

(2) The conclusions from the investigations about the relationship between frames, teaching and learning are based on data from a highly structured and sequenced subject like Mathematics (Dahllöf 1967, 1971b). Certain units of that subject are no doubt so basic for further studies as well as for practical application in real life situations that there are good reasons to talk about demands for mastery and also relatively easy to find out in what units mastery is needed. It has, by the way, also been possible (Dahllöf 1970) to trace the same basic pattern of findings in a quite different subject, Mother tongue (Swedish).

(3) The research has up to now been directed mainly towards one frame factor that for years has been subject to an intense political discussion in Sweden. A corresponding interest seems to have been devoted to the factor under consideration in connection with the debate on the comprehensive school reforms in other European countries, e.g. the Federal Republic of Germany. The frame factor considered here is the characteristics of the school class with regard to ability to achieve (ability grouping).

There are of course other frame factors. In general, the term frame factor may first be distinguished from the environment in general such as national and regional, economical and cultural population characteristics at large (cf. Dahllöf 1971b, p. 75). Thus frame factors of the school system are under the control of the school authorities and can - at least in the long run - be subject to deliberate change by them if not by the single teacher. For him and her it is a given, relatively fixed condition for a certain amount of time.

The frame factors of the school system may be physical (size and structure of buildings, etc.) and administrative, the latter ranging from time-tables for the different subjects over supply (but not actual use) of teaching aids to size and other characteristics of the class. It has to be observed that factors acting as fixed frames for a considerable amount of time at one level of the system, e.g. the teacher, are subject to manipulation by others at regular intervals. In this particular case, the Swedish parliament takes decisions about principles for grouping as well as about class size, time-tables and main objectives for the different school subjects while teachers within certain limits are free to choose the methods, textbooks and other aids best suited for promoting the various goals. Between parliament and teacher two agencies have to be added. The National Board of Education (NBE), which may be regarded as the executing branch of a ministry of education, has the top responsibility for the operation of the school system. In addition to the factors mentioned above, the NBE issues recommendations for the teaching which are included in the syllabus (the läroplan). The NBE nowadays also publishes planning guides for teachers. Textbooks are controlled by a certain board outside but parallel to the NBE.

The other agency of importance here is the local school board which in the curriculum area is responsible for the

school buildings for which there is state support and also for the budget and principles for purchasing textbooks and teaching aids. Some restrictions are that way introduced in the amount and variety of instructional aids at the teachers' disposal. (Cf. Dahllöf, Lundgren & Siöö 1971, Lundgren 1972, ch. 3.)

Effects of frame factors

The "official" point of view

Do frame factors like ability grouping really exert any influence? Isn't it once again the old story of non-significant differences?

Well, according to well-known reviews and empirical investigations by Ekstrom (1959), Borg (1965), Goldberg, Passow & Justman (1966) and Yates (1968), the "official view" is that ability grouping does not give rise to differences of any size, duration or consistency when the students' social background and initial level of ability is kept constant.

One has, however, to keep in mind that most research in the field is mainly descriptive and based on quite broad tests, the content validity of which seems to be low. On the other hand, content validity is important for conclusions about the effectiveness of a certain factor on teaching and learning. It does not seem meaningful to evaluate the effects of any frame factor, unless the functions tested have been subject to systematic treatment during the period when the factor studied has been in operation. For a more detailed critique on this point, see Dahllöf (1971b, ch. 1).

A re-analysis of a Swedish study by means of process data[1)]

The well-known Stockholm study by Svensson (1962, cf. also Husén & Svensson 1960, Husén & Boalt 1968, Yates 1966)

1) This section has with due permission and with only minor changes been taken over from a contribution to Paedagogica Europaea (1970/71). (Cf. Dahllöf 1971c.)

compared positively selected (PS), comprehensive (C) and negatively selected (NS) classes in grade 6, when the pupils had been differentiated from grade 5. From grade 7 all students were divided into theoretical or practical tracks, but the remaining effects of the different settings in grade 5-6 were also studied in grade 7-9. For students with an equal level of achievement and the same social background according to assessments made in grade 4, the over-all findings may be generalized as in Figure 1.

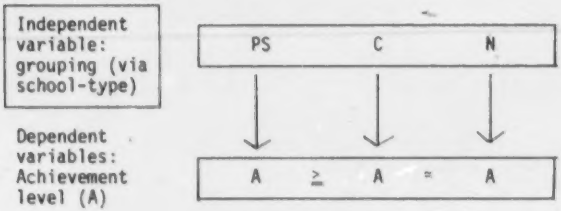

Figure 1. Main findings of the Stockholm study as reported by Svensson (1962)

Thus, in grade 6, the students from the positively selected classes were slightly better than those from the comprehensive ones, which in their turn achieved no better than those from negatively selected classes in the tests used. In grade 7-9, when the actual differentiation had ceased, all differences between early and late differentiated classes were reported to disappear, although the trends still follow the pattern from grade 6 (Dahllöf 1967a, ch. 7, 1971b, ch. 2).

The findings mentioned above are, however, subject to some limitations. The most important ones are the following (Dahllöf 1971b, p. 11 ff.).

(1) There are marked ceiling effects in some of the tests. In grade 6 this is the case in 6 of the 7 subtests of the intelligence test and in about half of the achievement tests in Swedish and Mathematics. In most

cases these ceiling effects are found in more than one of the groups under comparison, which may effect the distribution of stanine units.

(2) The tests intended to measure the effect of two years differential grouping in grade 6 are identical with the tests used as control variables in grade 4 (Svensson 1962, p. 78). Although this gives some explanation to the ceiling effects in grade 6 mentioned above, this is very unfortunate from the point of view of measuring the effectiveness of the educational process under varying conditions. It simply means that the outcome of instruction in the different systems is measured in very elementary functions of achievement. They are, indeed, so basic for the instruction in these grades that they have been included in the standardized achievement test battery already in grade 4, the year before the differentiation was introduced. Since the evaluation of the grouping arrangements thus is made in typical repetitive functions, already well established before the treatment, and as there also are marked ceiling effects in grade 6, the conclusion that differences between the systems are minimized is inevitable.

(3) In the negatively selected, "practical" classes in grade 8, students who did not take English any longer still were tested and compared with those who were studying it several periods a week. Also in Mathematics there were marked curriculum differences that invalidate all comparisons between early and late differentiated practical classes in grade 8.

(4) Ahlström (1963) showed that all comparisons in grade 9 were theoretically meaningless due to a selective transition to high-schools after grade 8.

(5) The differences between the time-tables in two of the three subjects tested (Swedish and Maths) were

underestimated. In general, the positively selected classes had a lower number of periods a week than the comprehensive ones.

In an earlier set of curriculum studies (Dahllöf 1960, Husén & Dahllöf 1960, 1965) data had been collected about the actual teaching situation in different school forms at the same time. These data had as yet not been used for any comparisons between school forms but only as explaining variables in studies of the relation between demands and attainments (including long-time retention of students) within the same school form. So far only the old secondary and elementary school systems had been analysed, while the data from the comprehensive schools, due to lack of time, had not even been tabulated.

Our own process data came from grade 7-9, so we can only make comparisons between early (from grade 5) and late (from grade 7) differentiated classes. The process study in Mathematics was made the same school year as Svensson (1962) collected his achievement data for grade 7. This means that achievement data from grade 8 were collected one year after the process data, but no curriculum changes had been made and both sets of data are fully representative for the school types compared (cf. Sitgreaves 1964). Due to a lack of certain identification data, process comparisons can only be made between positively selected classes and comprehensive ones. In their turn these, as in the Stockholm study, differed with respect to some background variables in favour of a higher formal level of teacher training for the positively selected classes and a smaller class-size in the comprehensive ones (Dahllöf 1967, ch. 12, 1971b, ch. 7).

The questionnaires called for retrospective ratings by the teachers after the school year was finished. Two types of process variables were studied, viz. the general method of teaching and the number of lessons spent on different curriculum units. The curriculum was originally broken down

into 50 units but for our purposes it is sufficient to distinguish only between two main groups, elementary (E) and advanced (A) ones.

As to basic methodology, about 95 per cent of all teachers made use of a slightly modified traditional instruction pattern, implying that every new curriculum unit was introduced at the same time for the whole class. Individualization by speed may occur within each unit, but was not allowed over units. This means that more rapid pupils were not permitted to take up a new unit until their slower classmates were ready for it.

The time ratings allowed us then to estimate numerically the content validity of the tests used by Svensson (1962) by comparing the distribution of the test items over 12 groups of curriculum units and the time actually allocated to these groups. In general the coefficients were low. The great bulk of test items were shown to refer to elementary objectives.

So far, the generality of the findings shown in Figure 1, may be still more limited: The approximate equality of attainments in the two types of grouping refers only to the elementary objectives of the teaching. Thus $\underline{A}$ should be changed to $\underline{A}_E$.

The next step in the analysis was to calculate the estimated teaching time for the elementary units in the two school systems. The number of lessons spent on elementary objectives in grade 7 was not only significantly but also considerably less in the positively selected classes than in the comprehensive ones (the relation being as 13 to 39 out of a total of about 95 for the whole school year). In grade 8 the differences, although smaller, were in the same direction.

Since the time total was about the same for both school-forms, a much greater number of lessons were allocated

to advanced curriculum units in the positively selected classes. If these classes reach the same level of attainment in elementary units in a much shorter time, it was concluded that their level of achievement in advanced units reasonably should be higher, although this was never tested.

The new pattern of findings, including the process analysis, can be summarized as in Figure 2. The interpretation of it has been reported in detail by Dahllöf (1967, ch. 16-18, 1971b, ch. 9). A reanalysis also of two other studies by Carlsson (1963, cf. Sjöstrand 1967) and by Borg (1965) has been very helpful in developing the final model that is the main theoretical outcome of this study.

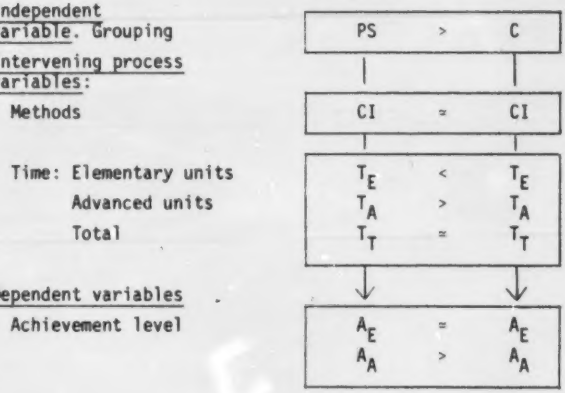

Figure 2. The Stockholm study re-analysed: Main findings with regard to classroom instruction (CI), time and attainments in elementary and advanced curriculum units.

When discussing comprehensive and selective school systems from different points of view, Husén & Boalt (1968, p. 103) have asked: "What price is to be paid for a high standard achieved by a few?" In Sweden most responsible administrators

and politicians planning the comprehensive school reform no doubt were quite prepared to pay a price in the cognitive area for expected benefits with regard to social equality in recruitment to higher studies, attitudes towards school, teachers, classmates, etc. As a matter of fact, the old secondary school (realskola) had since long (SOU 1946:48) been heavily criticized for having too limited intellectual goals.

So far the first test-based interpretation of the Stockholm study (Figure 1) may perhaps be said to have shown too much. Taken at their face-value, the findings simply imply that there was no price to be paid at all for the expected benefits with comprehensive classes in other respects. This is also theoretically intriguing, since no explanation is offered for the quite unexpected findings. Our own re-analysis of the Stockholm study by means of process data shows on the other hand that there is a price, but that this price is paid in terms of time for an equal standard in elementary mathematical curriculum units. Moreover, there are strong indications that the level of achievement in more advanced units probably is higher in the positively selected classes than in the comprehensive ones, but nobody has tested anything but very basic functions.

From a practical point of view the findings seem to indicate at least two main alternatives for those who are considering a school reform with comprehensive classes also in the higher grades. The one "solution" would then quite simple be to pay the price for the benefits in other respects, examples of which, based on the Swedish debate, have been indicated above. The other and perhaps more constructive solution would be to lower the cost by trying to abandon the class-centered pattern of teaching in favour of much more individualization within the comprehensive classes. As a matter of fact, the Swedish National Board of Education - in spite of the first research findings - has recommended this very heavily and also supported the

development of those types of self-administrated instructional packages that seem to be a necessary pre-requisite if the teachers should be able to manage such a program. The production of material-methods systems of this kind did not, however, start until the reform was launched, so there were no teaching aids of this type at hand during the first period of the new school. Of course the basic and in-service training programs for the teachers have also to be considered in a coordinated implementations program.

Frame factors, teaching and learning for mastery

The findings reported in the preceding section have given rise to a theoretical model (Dahllöf 1967, 1971b) about the relationship between frame factors like grouping, the teaching process and the educational outcomes. Some parts of this model have special reference to the prevailing theories of mastery learning and at the same time the problem of teaching for mastery is brought into focus.

The model cannot be described in detail here (cf. Dahllöf 1971b), but the following characteristics ought to be emphasized in this connection:

(1) The fact that - when initial ability and social background were kept constant - there are almost no differences of any practical importance between students from positively selected and comprehensive classes in elementary curriculum units gives no doubt support to mastery learning theory.

(2) Also the fact that the equal standard in the basic tests was achieved by the two groups at the expense of quite different amount of time seems to be in full accordance with basic assumptions in mastery learning theory (see esp. Bloom 1971b).

(3) Most of the elementary units tested are so basic that

one is justified to talk about a need for mastery both with regard to further studies in a highly structured subject like mathematics and with respect to the practical demands of daily life. This has, by the way, also been shown empirically in earlier curriculum studies (Dahllöf 1960, Husén & Dahllöf 1960, 1965).

(4) The time differences mentioned above should be interpreted with due regard to the basic strategy of teaching used by the teachers. This is an important restriction on the data which means that there was no individualization over curriculum units. When a new unit was introduced the teachers to 95 per cent addressed the class as a whole ("Frontalunterricht"), although some individualization with regard to rate of learning took place within each curriculum unit.

(5) The basic frontal teaching pattern may in its turn be a consequence of another restriction, viz. shortage of appropriate teaching aids for an individualized instruction but also lack of know-how about the teaching of comprehensive classes in general.

(6) The combination of (a) the traditional teaching pattern with no individualization over curriculum units and (b) relatively strong demands on something like mastery in elementary parts of the syllabus seems to give rise to a certain mechanism as to the rate of progress over the school year in the two types of classes: There are strong indications that a certain part of the class is acting as a reference group for the teachers' decisions to take up a new topic. Thus, this group sets the pace for the instruction. The group has been described as a "steering-criterion group" (Dahllöf 1967, ch. 16-17, 1971b, ch. 9-10). For elementary curriculum units there are indications that students somewhere in the region between the 10th and 25th percentile of the class are acting as such a reference group.

(7) The interactions described above explain why there are so striking teaching time differences in favor of the positively selected groups behind the non-significant differences in achievement in elementary tests. With regard to more advanced curriculum units it can also be predicted that the positively selected classes should excel the comprehensive ones either in performance level or number of advanced units mastered or both. For a further development of the model see Dahllöf & Lundgren (1970) and Lundgren (1972).

Some further considerations about teaching for mastery

So far we have been able to look upon some recent Swedish research data on the school differentiation problem from the standpoint of mastery learning. The contribution is, however, restricted to a special case (elementary curriculum units in mathematics) under limited conditions (traditional teaching methods), but within that frame of reference it seems as if data do support some basic assumptions in mastery learning theory from an educational-sociological direction in contrast to the psychological approaches by Carroll (1963) and Bloom (1968, 1971b). The special case to which our study is limited, is probably a field well suited for mastery learning.

At the same time the perspective of our study makes it quite clear that we have to consider another frame factor with far-reaching consequences for any teaching program aiming at mastery: Total time at disposal is restricted both for a certain subject and at school in general.

It is true that schooling may be prolonged and that the principles of recurrent education or life-long learning may mean an important increase in the resources for human learning and development. But even in this case, that in most countries call for immense investments in the education sector, there are such time limits. Let us therefore discuss the problem within the frame of reference of the school

systems that are a fact here and now. Neither makes it any profound difference if the allocation of time to different subjects in one country is decided on by the Ministry of Education and in another setting by the local school board or even the teacher.

If mastery learning will be supported by further research data as a valid general principle and if it is going to be developed as a central principle for educational planning (cf. Block 1971a), the fact that total time at disposal is a definite frame factor for the teaching for mastery draws attention to the following possible consequences that many no doubt would regard as great risks for the future.

There may be a strong demand for mastery - and a corresponding allocation of additional time - in subject matter areas that are the favorites of influential pressure groups. A corresponding stress can be expected in subjects with a strong test tradition, especially on easily measured aspects, e.g. on low taxonomical levels according to Bloom et al. (1956). An increase of the interest in these parts of the curriculum does not in itself represent anything negative, but it may become a real risk if the total time is neglected, if time needed for mastery is underestimated and if too much time, deliberately or unintentionally, is taken from other areas that do not have prominent spokesmen.

A mechanism of a similar kind seems, by the way, to have been operating behind the Swedish curriculum changes in connection with the comprehensive school reform. As has been shown in detail elsewhere (Dahllöf 1971d, ch. 5), the net result of the two curriculum reforms in 1962 and 1969 has been an increase in the time-table for the formal communication skills, especially mathematics and - with the exception of religion! - a great loss for the so-called orientation

subjects like history, geography, civics, biology, physics and chemistry.

In any case: The priority problems is brought into focus and has to be given priority in the qualitative planning of education both within subjects and the total balance of the curriculum. In turn, this calls for a better integration not only of educational psychology and theories of curriculum and teaching, but also for a closer relationship between these fields taken as a whole and the domains of educational philosophy - and politics.

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3. THE CURRICULUM DEVELOPMENT SYSTEM IN SWEDEN: SOME COMMENTS ON PRESENT TRENDS AND PROBLEMS

Reprint from International Review of Education 19, 1973, 218-230

The preceding articles by /in this issue/ Johnson and Alkin have offered a fairly clean and clear-cut treatment of the main dimensions and levels of planning and operation in curriculum development in general. In this paper some specific factors are introduced that should be considered when analysing present trends and problems in the Swedish system. In doing so we are no doubt running the risk of highlighting "the complexities of a national system", but this may be justified since the complexities seem to be quite large even at the classroom level (Smith & Geoffrey 1968).

Since all recent school reforms in Sweden have taken place at the national level and have also been regarded as an important means of bringing about a general change in society, we must put a certain stress on the macro-level problems (esp. M") but at the same time it is clear that most of the problems that have not been dealt with very successfully seem to be connected with the implementation and follow-up strategies, i.e. the relation between the macro- and modal-levels. Therefore it is necessary to consider the problem of timing different reform steps as well as the main means by which the intentions are expected to be transformed from the macro- to the classroom-level.

Phases in a reform cycle

When reforming a centralized school system like the Swedish one, one can distinguish between the following broad phases: (1) planning; (2) decisions concerning goals and structures; (3) introduction and implementations; (4) operation, and (5) follow-up. A follow-up can in its turn give rise to new decisions of the second phase type. If a follow-up is done

in connection with an implementation programme and the decisions taken are mainly about the means - administrative and pedagogical - for achieving the ends, we may speak of a supplementary reform and the first follow-up as a phase of formative evaluation on a system level. Thus, the main characteristic of a supplementary reform is that there is no fundamental change in the main goals and general structure of the system (at level M"). A follow-up of an old system may, of course, also be a starting point for a basic goal-changing reform.

Second phase decisions, concerning goals and structures, are often taken in two steps: first, the main goals and the general structure of the system with regard to tracks, time-tables for different subjects and, second, the more detailed break-down of objectives, sequencing and instructional planning (M') within the system.

Role of frame factors

Schools operate in an environment with its own geographical, ecological, economical, social and cultural characteristics. As has been discussed more fully elsewhere (Dahllöf 1967, 1971a, 1971b), many of these are outside the influence of any part of the school system, while others - at least in principle - can be changed at some level in the educational system. This means that such environmental factors are subject to manipulation by the system itself while they act as fixed frames at lower levels of the system until the next change is made.

Factors of this kind have been called environmental frame factors or simply frame factors (Dahllöf 1967, 1971a, 1971b; Lundgren 1972). They can be physical and ecological (size and structure of school buildings, distance between home and school, etc.), administrative or pedagogical. Administrative frames often take the form of laws or rules, e.g. for class-size, admission, total time for the teaching of a certain subject in terms of hours per week, etc.

Pedagogical frames most often seem to be stated in the form of prescriptive principles and general recommendations, e.g. contents to be covered in a common core (if any), general style of teaching (class-centred instruction, individualization, non-grading, etc.). The pedagogical frame factors can also include the hardware of the teaching aids, and the software in terms of the stock of available programmes that the community has purchased or the corresponding sum of money that may be put at the teachers' disposal for this purpose. However, the actual use of teaching aids belongs to the process of teaching itself.

In the Swedish system decisions concerning frame factors, such as time-tables, main objectives and rules for grouping and class-size, are taken at a high level of accountability (Alkin 1972) by Parliament, the Ministry or at least by the National Board of Education which issues recommendations about teaching methods, instructional planning guides, etc. Implementing the reform is not only a question of taking logical and psychologically coherent steps from macro- to micro-level but also to do this and keep the system going at the operational level within these given frames. It goes without saying that a reform leading to direct success without any correction of the frame factors as a result of feedback from the operational level of the system makes great demands on the planners with regard to their skill and imagination in estimating the necessary distribution of time, methods, and aids when teaching new courses to a given group of students. When a reform - as has been the case with most Swedish reforms in recent years - also implies a profound change in the structure of the classes (i.e. the grouping policy) it must by definition be still more difficult to arrive at the optimal combination of frame factors at once. The task will no doubt be easier if there is reliable knowledge at hand for planners and decision makers about the influences of different frame factors as well as other parts of the environment.

Consequences for research

Research in this area of the educational field cannot, however, confine itself to traditional micro-studies of the psychology of learning or to short term studies of classroom behaviour, be it micro-teaching, classroom interaction or evaluation studies of instructional programmes. It is also a compelling necessity to consider the cumulative effects of the reform on the teaching-learning interaction pattern over a long period, say, at least one school year.

Nevertheless, when decisions on the main goals and the corresponding frame structure are taken, we can say that this structure is expected to bring about an optimal goal attainment, provided that a series of implicit and explicit conditions are met by different types of personnel at the administrative and classroom level in the field. These conditions are often very trivial. If certain courses are given in order to train the teachers to master a new technique, those who have been trained are at least expected to practise the new skills in their further classroom teaching, to use new teaching aids, etc. Unless conditions of this type, provided that they represent a sine qua non, are fulfilled, there is no reason to expect any changes in terms of test results or other similar outcome measures. Thus it is often better to postpone the construction and administering of detailed test programmes in favour of making a prior survey of the actual teaching process itself. Follow-up studies of this type may, of course, in their turn be combined with an analysis of results in terms of test scores. The broader approach, comprising process conditions, may be called functional analysis in contrast to the criterion-related result analysis (see Figure 1). In relation to the expectations in the early stages of the planning, expressed in the decisions on new goals and frames, one may regard a functional follow-up study as a test on the validity of these expectations. If all

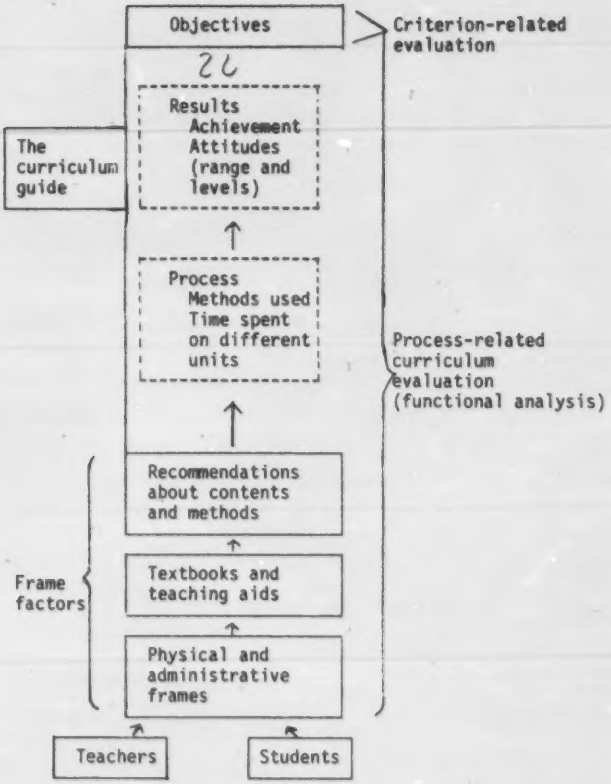

Figure 1. Relation between curriculum, frame-factors and different types of evaluation in a curriculum development situation.

conditions of the type mentioned above are met in the field by a majority of classes, the same follow-up study can be regarded as a test of the implicit or explicit theory of teaching or instruction that forms the basis of the reform.

Summary of intra-system factors and relations

So far we have been dealing mainly with the relations between goals, frames, processes and outcomes in a reform situation where the main decisions concerning the goals and general structure of the system have already been taken. The discussion can be illustrated by Figure 1 in which the syllabus, issued by the Swedish National Board of Education, is regarded as containing all the important frame factors. (The fact that this is not always the case is irrelevant, for this purpose.)

Figure 2 shows in more detail how the frame conditions and recommendations in the syllabus affect the classroom teacher through different intermediate sources. Their relative role may vary with subject, stage and context (Lundgren 1972, Ch. 6). Since we have been stressing the centralized character of the Swedish system, we ought to draw attention to the fact that within these frames the individual school as well as the teacher has considerable freedom in sequencing the contents, in choosing textbooks and methods of instruction and teaching aids. In practice,

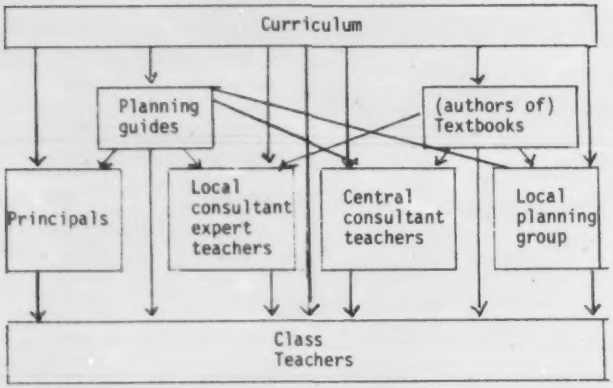

Figure 2. A general paradigm of the relation between curriculum and teachers in Swedish schools.

there are, however, strong indications that the textbook, when chosen, exerts a considerable influence on certain aspects of the teaching process.

Knowing the textbook is, however, by no means a sufficient key to knowledge of the teaching process. Frame factors, like characteristics of the class, are also of great importance (Lundgren 1972).

Policy-making and planning for new goals in a changing society

Although the decisions on main goals and general structure of the educational system are political acts, they are very often characterized by considerations regarding a number of goals which have varying degrees of importance for the total system. Decisions of this type - and their preparation - are, however, not entirely a philosophical affair. There is also place for theoretical and empirical research, at least when assessing the state of affairs in a given respect and the need for changes - in quantity and quality - in order to fulfil the ends. If social equality is an important goal for the new reform, the planning of the new system may be helped by information not only about the actual enrolment from different social strata but also about the underlying mechanisms. Decision-oriented studies in connection with school reforms have been prevalent in Sweden since the middle of the 1950s. They have been summarized by Husén & Boalt (1968) according to topics. Many of these studies deal with needs: the students' needs for a general education and for self-realization; the needs of society for citizens capable of taking an active part in democratic political life, but also with skills useful in vocational life. Needs of knowledge and skills and their corresponding demands on the system can - at least in principle - be assessed by various direct and indirect methods. As is pointed out by Johnson in his paper, the outcomes of the old system that is going to be reformed may furnish a good starting point for decisions about necessary changes when related to present demands - or estimated future needs.

The Swedish curriculum development system

We will now consider in more detail the Swedish curriculum development system as exemplified in the most recent Swedish school reforms. The following three reform cycles have been chosen:

(1) The comprehensive school reform of 1962, formulated by the 1957 Committee on the Comprehensive School (and before that also by committees in the 1940s, as mentioned by Alkin in his paper).

(2) The secondary school reform of 1964, formulated by the 1960 Secondary School Planning Committee.

(3) The steps for the revision of the new comprehensive school in 1969, drawn up by the National Board of Education and especially by its department UA 1. This revision was planned and announced as a supplementary reform according to the definition given above but, as will be demonstrated later on, substantial changes were introduced both in the main goals and the general structure of the school.

Until the secondary school reform in 1964 (there was also an additional reform introducing the new continuation school, but this is not considered here) changes in the school system were planned by ad hoc governmental committees, the members of which very often were "enlightened laymen", e.g. Members of Parliament specializing in educational affairs, representatives of the trade unions, etc. The 1957 Committee was chaired by the Minister of Education himself, the 1960 Secondary School Committee by the Director General of the National Board of Education. Committees of this type had a secretariat of their own; their secretary generals were high officials in the educational administration and were assisted by a great number of expert groups, with teachers predominating.

In the beginning of the 1960s, however, a new planning policy was introduced. A great number of the administrative duties of the National Board of Education were decentralized to regional or local authorities and it was given much more responsibility for national planning and continuous revision of the school system according to the principle of a "rolling school reform". The 1969 reform for the revision of the comprehensive school was the first outcome of this new principle.

In the following paragraphs an attempt will be made to summarize the trends in the curriculum development system by means of estimating the roles played in the different phases by the various types of activities as described above. Since the aim of this paper is to map out the regions of main concern and the most important trends, no attempt has been made to secure group measures. The validity of the assessment rests with the arguments and the references which form the basis for every point. For more detailed verification see Husén & Boalt (1968) and Dahllöf (1971a). It goes without saying that in this connection every type of systematic activity must be considered, such as research studies, developmental projects and planned information programmes aimed at securing information as a basis for various decisions in a reform cycle, spelling out the intentions of the reform, informing and motivating administrators, teachers, students and the public, etc.

Planning

In the planning of the new comprehensive school most systematic efforts were aimed at examining the problems of the organization of the upper section (grades 7-9). The problems of differentiation (Husén & Henrysson 1959; Husén 1962; Dahllöf 1967) were debated intensively. A very important part of the planning activities was concentrated on the adaptation of the option system to the needs, interests and capacities of the students, especially with regard to intra-individual differences (Härnqvist 1960). The

effects of social background factors on academic career, which had been the subject of a series of earlier studies (Boalt 1947; Husén 1948; Härnqvist 1958; 1965; Härnqvist & Bengtsson 1972) were also considered seriously (SOU 1961: 30). Finally, the first series of systematic curriculum studies in Sweden was carried out in connection with this reform, testing the actual teaching in the traditional school forms against assessments of needs not only in different vocations and vocational training schools as well as upper secondary schools but also in leisure time from the individual's point of view. However, this was done only within 5 subjects and the data by definition did not lend themselves to conclusions about relations between subjects. (Husén & Dahllöf 1960, 1965; Dahllöf 1960; Johansson 1961; Bromsjö 1965.)

The planning of the 1969 revision of the same school system did not make use of very many systematic studies besides the routine school statistics which have data for the actual choice of options among the students and which were connected with certain economic estimates about the costs for different types of option systems (Skolöverstyrelsen 1967). This holds true even when one considers the follow-up activities of the 1962 decision which are listed below.

The 1960 Secondary School Committee launched a comprehensive planning study programme comprising both quantitative statistical studies, e.g. on manpower demands for different types of training within broad sectors, the secondary school turn-out rates in different streams, etc. (SOU 1963:41, SOU 1963:42) and qualitative studies concerning the students' attitudes towards the old system, their plans for the future and the influence of social background factors (Härnqvist & Grahm 1963) as well as the present and estimated future demands from the "receivers" - universities, commerce and industry (Dahllöf 1963). Most of these studies have been summarized elsewhere in more detail (Dahllöf 1966). In no case did they

Studies of Needs Among:	Planning Agent: 1957 Comprehensive School Committee 1962x/1962†	1960 Secondary School Committee 1964x/1965†	National Board of Education 1969x/1970†
Students	+++ Intra-individual differences/ options	++ Options, attitudes/ background	+ Option statistics
Teachers	-	(+) (Latin only)	-
"Receivers"			
Present Trends	+ Within 5 subjects	++ Between subjects	-
Future Trends	-	+ Trend ratings	-
Old System/Needs	+ Within 5 subjects	++ Between subjects	-

x) Reform decision
†) Reform begins

Table 1. Main characteristics of the planning process in three Swedish school reforms in the 1960s.

have any direct influence on decisions but were considered by the planning committee in combination with other studies and other types of data according to the committee's own basic principles (SOU 1963:42).

The summary in Table 1 shows that in no case were any systematic surveys made among the teacher, with one small exception (Latin). On the other hand it has been argued that the many experts used in the planning of new

curricula - mainly carried out in small working groups as is shown in Table 1 - eliminated the need for information from teachers. The detailed work in phase M' has been referred to in the implementation stage after the main decisions were taken.

Main decisions

It would be beyond the bounds of the present paper to describe the content of the reform decisions here. Both the 1962 and 1964 decisions were big reforms in their respective fields. The 1969 reform was intended as a supplementary reform but in fact it also contained several modifications both in main objectives and general structure, even though these were not as far-reaching as those of the preceding reforms.

Implementation strategies

As stated above, the new curricula were planned in working groups consisting mainly of teachers. In some cases there were systematic data at hand that could serve as a starting point for the planning. As far as the comprehensive school reform is concerned, data had been collected and measures pre-tested during the experimental period since 1950, but in spite of this many other changes were introduced both in organization and curricular contents. Only one big evaluation study (Svensson 1962) was made about the effects of the intended grouping system on scholastic achievement, which has been discussed and interpreted elsewhere (Dahllöf 1967, 1971a). Projects aimed at promoting the individualization of instruction were launched after the reform decision but they will be completed several years after the system has been in operation. Most efforts were concentrated on planning guides and in-service training courses for teachers (Table 2). In one case, the 1969 reform, a special project has been devoted to an evaluation of the implementation programme (Eklund 1971).

	Planning Agent		
	1957 Comprehensive School Committee 1962x/1962†	1960 Secondary School Committee 1964x/1965†	National Board of Education 1969x/1970†
Curriculum planning in detail:	Working groups	Working groups	Working groups
Information	++	++	++
Planning guides	+	++	++
In-service training	++	+++	+++
Package projects	(+) Late	+ (New Math)	+
Pretesting system	+ (Partial, mainly organization)	-	-
Follow-up of implementation	-	-	(+)

x) Reform decision
†) Reform begins

Table 2. Main characteristics of the implementation process in three Swedish school reforms during the 1960s.

Reform follow-up

On the quantitative side the reforms have been followed up in the ordinary school statistics and, in the case of the 1964 secondary school reform, also through certain special studies on the causes of the unexpected high drop-out rate in some of the new tracks. This was done as a part of a follow-up project (LAG) within the National Board of Education (Cervall 1969).

On the qualitative side little has been done, especially in terms of systematic surveys of the changes in the educational process. Also, in this case the LAG-project is an exception with small in-depth studies in selected schools combined with broader surveys of certain key problems in the reform, e.g. the new independent study programmes

(Richardson & Siöö 1970). Cooperation has also been established with some conclusion-oriented research projects (Dahllöf & Lundgren 1970; Dahllöf, Lundgren & Siöö 1971; Lundgren 1972).

	Planning Agent		
	1957 Comprehensive School Committee	1960 Secondary School Committee	National Board of Education
	1962x/1962+	1964x/1965+	1969x/1970+
Quantitative			
(Options, drop-out)			
Ordinary statistics	+	+	+
Studies	-1)	+ (LAG)	?3)
Qualitative			
Informal	+	+	? but re-
Systematic testing	-	(+)2)LAG	? commended
Process analysis	-	+	?

x) Reform decision
+) Reform begins
1) Later on such studies were done for the 1968 Educational Planning Committee (U68) but this did not affect the 1969 reform (Bengtsson 1972).
2) Mainly through comparison of marks having standardized achievement tests as a starting point for the assessment. No criterion-related assessments studies are known.
3) As the reform was launched only in 1970 it is too early to make any judgments about the follow-up strategies. Recommendations have been given but seem not to have been followed very far.

Table 3. Main characteristics of the follow-up activities in three Swedish school reforms during the 1960s.

Conclusions

With regard to the criteria used in this review, two main conclusions seem to be justified: (1) In the school reforms of the 1960s the main stress has been on systematic activities in the planning phase, while the follow-up phase has been relatively neglected in spite of an intense public debate. (2) There was an increase in deliberate systematic curriculum development activities up to the 1964 reform and

its follow-up - an increase that is much more marked when compared with the conditions during the 1940s and 1950s - but it seems as if the introduction of a principle of "rolling reform" by the National Board of Education has been followed by a decrease in the systematic collection of data to underpin the new decisions. It is, however, true that the budget for the new Bureau for School Research has been increased considerably during the same period, but many of the new projects are scattered according to the "watering-can" principle and on a "lower" problem level and have not been coordinated with the time-tables for the reform phases at the macro-level (Alkin & Johnson 1971, 1972).

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